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CONSIDERATIONS ON THE USE OF A CAAF CONTRACT FOR THE ENGINEERING DEVELOPMENT OF THE XM 712

STUDY REPORT

PMC 73-1

BENJAMIN A. HUGGIN
MAJOR USA

CONSIDERATIONS ON THE USE OF A CPAF CONTRACT FOR THE ENGINEERING DEVELOPMENT OF THE XM 712

An Executive Summary
of a
Study Report
by

Benjamin A. Huggin
Major USA

May 1973

Defense Systems Management School
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DEFENSE SYSTEMS MANAGEMENT SCHOOL

STUDY TITLE: CONSIDERATIONS ON THE USE OF A CPAF CONTRACT FOR THE XM 712 PROCUREMENT.

STUDY PROBLEM/QUESTION:

To investigate cost plus award fee contracts, examine a procurement and propose an award fee plan.

STUDY REPORT ABSTRACT:

The cost plus award fee contract is gaining favor in the weapons acquisition process, however it is not widely understood by many managers. This paper develops more information on CPAF contracts than is in ASPR, discusses the planned procurement of full scale development of the XM 712 Cannon Launched Guided Projectile and proposes an award plan based on the information available.

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Date
May 1973

EXECUTIVE SUMMARY

The cost plus award fee (CPAF) contract is gaining favor in the weapons acquisition process as it provides a means by which the government may directly influence the contractor's performance during the course of a contract by offering a reward for quality in specified areas. CPAF contracts are not widely used and therefore not widely understood. There are limited guidelines in the Armed Services Procurement Regulation (ASPR) upon which an almost endless number of variations can be built. The CPAF contract offers a two part fee, one part fixed and one part a function of the government's subjective judgement on performance. The non-fixed or award fee determination is not subject to the Disputes Clause. The CPAF contract does require more extensive administration and control and can not be used just to avoid setting incentives that can be measured.

The XM 712, a Cannon Launched Guided Projectile, is managed by the Project Manager, Cannon Artillery Weapons Systems, PMCAWS. It is a unique artillery round which is laser guided for employment in an anti-tank round. The complexity of the round, requirements for a minimum schedule and uniqueness of some tasks make this procurement suitable for a CPAF contract. The author recommends, based on limited data available, the use of a CPAF

contract with an award fee placed on six criteria. An award fee plan is presented that could be finalized and negotiated into the development contract.

CONSIDERATIONS ON THE USE OF A CPAF CONTRACT FOR THE ENGINEERING DEVELOPMENT OF THE XM 712

STUDY REPORT

Presented to the Faculty
of the
Defense Systems Management School
in Partial Fulfillment of the
Program Management Course
Class 73-1

by

Benjamin A. Huggin
Major USA

May 1973

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The author expresses his gratitude to Colonel Sterling Post, PM, CAWS, for his kind assistance and the unreserved services of the personnel in his project office in providing information on the XM 712 development.

Contents

CONSIDERATIONS ON THE USE OF A CPAF CONTRACT FOR THE XM 712 PROCUREMENT*

Introduction

One new type of cost contract that is gaining acceptance and is being employed during the development phase of weapons acquisition is the Cost Plus Award Fee (CPAF) contract. This type of contract has the unique feature of being able to reward the contractor for his good efforts during the course of the contract and can be used as an inducement for the contractor to be more responsive to the contracting agent. As this type of contract has not been widely used, it is not understood by many managers. The purpose of this paper is to investigate the CPAF type contract and propose an award fee plan for the use on the Engineering Development contract for the XM 712, Cannon Launched Guided Projectile.

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*ABSTAINER

This study represents the views, conclusions and recommendations of the author and does not necessarily reflect the official opinion of the Defense Systems Management School nor the Department of Defense.

Chapter 1

CPAF Contracts

CPAF contracts are specifically addressed in section 3 - 405.5 of the Armed Services Procurement Regulation (ASPR). This type contract is a cost reimbursement contract with provisions for a special fee which is paid during the contract at regular intervals as an award to the contractor for performance that could not otherwise be measured finitely. The total fee paid to the contractor is made up of two parts, a fixed fee and an award fee. The fixed fee is based on the dollar amount of the contract and is paid to the contractor in all cases. This normally is about 3%. The award fee however, must be earned by the contractor. The amount to be earned is based on how well he performed in areas such as ingenuity, timeliness, and quality as determined by the subjective judgement of the government. This is not to imply that the government makes a haphazard assessment of the contractor's performance. The government must pre-select criteria on which to base its judgement and must apply a plan or formula to weigh the criteria and rate the contractor's performance. The determination of how well the contractor performs against the plan is made by the government. The

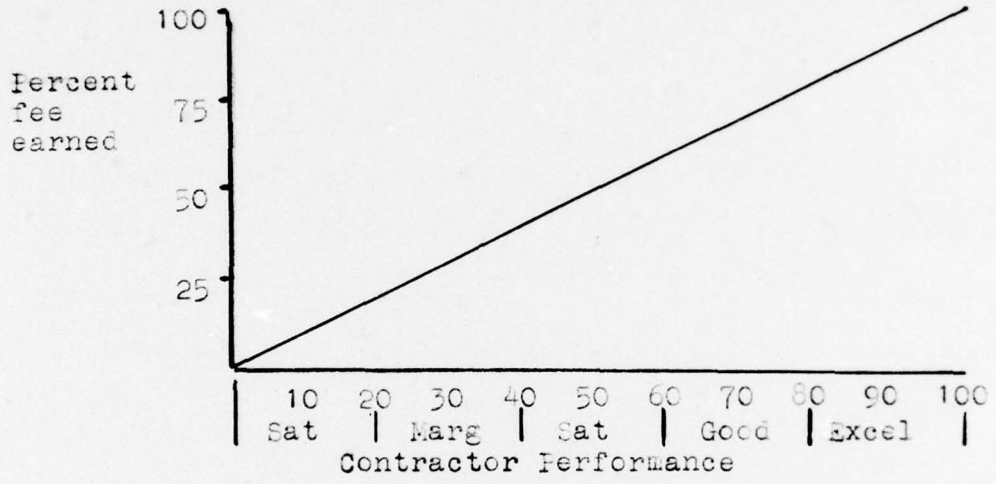
The total fee is limited by law, Title 10, U.S.C. 2306 (d), as specified in ASPR section 3-405.6 (C) (2), to 15% of the estimated cost of experimental development or research contract, exclusive of the fee. The government agent, if he desires to achieve the full benefit of incentivising, must be willing to commit the fully allowable fee for truly outstanding performance. A note of caution must be added here. The intent of the CPAF contract is to reward a contractor for quality work performance. If the government never intends to allow the full fee, the intent of this type contract will be destroyed and contractors will not accept them. This note of caution becomes clear when considering that the determination of the amount of fee that will be paid for any rating period is determined unilaterally by the government and is not subject to the Disputes Clause of the contract.

CPAF contracts are suitable for level of effort contracts where feasibility is established, but measurement of achievement must be subjective rather than objective. This type contract was developed by National Aeronautical and Space Agency (NASA) for service type contracts in which quality of service was rewarded. CPAF is also applicable to work which would otherwise have been placed on another type contract if performance

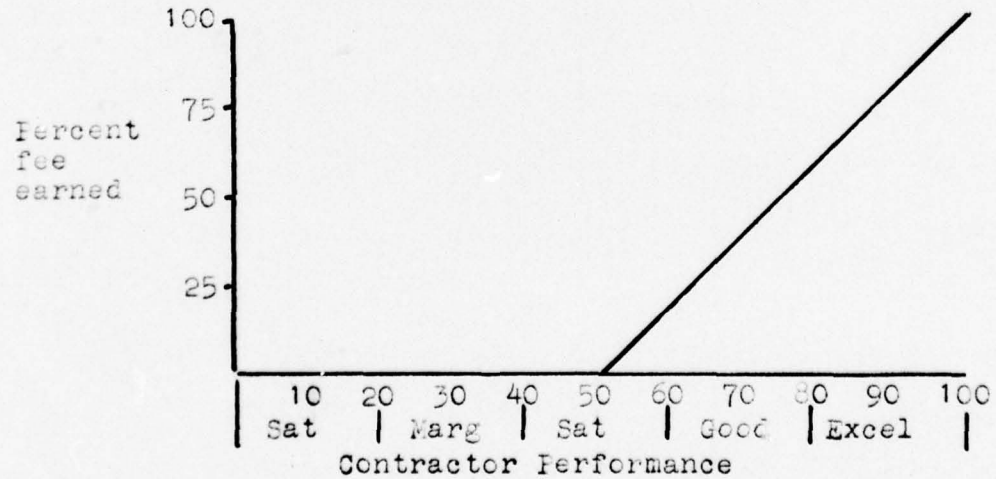
measurements could have been expressed in advance. CPAF contracts are not however to be used to avoid Cost Plus Fixed Fee or Cost Plus Incentive Fee which require that objective targets be established prior to the contract. As administration of the CPAF contract is costly, short term efforts should avoid the CPAF contract.

The heart of the CPAF contract is the establishment of meaningful criteria on which to judge the contractor's performance and the appropriate application of weighting. The first approach to determination of the criteria on which to base an award is for the government to decide on the objectives of the procurement. If the objective is simply performance- a 5,000 pound vehicle that can travel at 50 miles per hour- then no further consideration should be given to the CPAF contract. Similarly, if the objective is to study an idea, the government should look to another type contract. However, if the government is looking for quality work done in a timely manner, by an effective contractor (one who consciously attempts to save the government money) and is willing to pay for this, then CPAF should be pursued. After deciding on the criteria, the next task in setting up the award plan is to decide at what point the government will begin to pay the award (the award fee formula). The establishment of the award fee formula is very important. There are two end cases to consider: (1) the government will begin

paying the award fee at the lowest acceptable level of performance, figure 1, and (2) the government will begin paying at a point called " satisfactory," figure 2.



AWARD FEE FORMULA (1)
FIGURE 1



AWARD FEE FORMULA (2)
FIGURE 2

There are good and bad features in each base case. Under formula (1), the contractor is penalized for less than satisfactory work, but would receive some amount over the base fee in almost any event. Under the concept in formula (2) the emphasis is on excellence- high gains for more than satisfactory work, but no penalty for less than satisfactory work. In general, the government would be well advised to avoid the type (2) formula for two reasons. First, management at the contractor plant may not be made aware of less than satisfactory work. Second, many managers in the contract plant are judged by their " profit." The penality for less than satisfactory work thus becomes a flag to management and the government is assisted by management in returning the profit and performance to at least a satisfactory level. The optimum setting of the award fee formula would be between (1) and (2) and based in part on the philosophy of the contactor's corporate management and in part on the desires of the project manager.

The government must also decide how to distribute the award fee over the life of the contract. The distribution should be affected by critical points during the contract. For example, if the initial stages of the contract are critical, a distribution

over four periods may be as shown in figure 3.

PERIOD	1	2	3	4	TOTAL
% of TOTAL	50	30	20	10	100

DISTRIBUTION OF AWARD FEE

FIGURE 3

The project manager must initially decide on what criteria to judge the contractor. Depending on the type of effort, he may want to establish several general categories, such as timeliness, technical operation and quality. Within each of the general categories he may select multiple criteria on which to judge the contractor. For example, under technical operations, the criteria may be " effective and efficient accomplishment of technical events" and " responsiveness to technical changes." Within each criteria, specific factors may be selected to judge how well the contractor met the criteria. The level to which the project manager desires to go will be dependant upon the complexity of the development. A more complete look at one category may be:

Category: Technical Operation

Criteria: 1. Responsiveness to technical changes.

Factors: a. Configuration of control.
b. Responsiveness.

The factors may change from rating period to rating period depending on the concerns of the project manager for each rating period. Once the rating factors are established, the government must establish some type of plan to judge how well each factor was met. This scheme is on a 1-10 scale with adjective ratings, corresponding to ranges of values, i.e., good = 7-8.

For each rating period, the government selects those factors which are most critical to the program and assigns a relative weighting to each factor. Weighting of the factors allows the project manager to give greater emphasis to separate rating factors. The factors selected additionally highlight those areas in which the contractor was weak during the past rating period.

To be able to perform a valid evaluation of the contractor, the government must appoint an evaluation board or some similar body to monitor the contractor's efforts. Members of the evaluation board should be directly concerned with the contract and knowledgeable in the area to be judged. Data on which to judge performance must be gathered by some established method-written reports, visits to the contractor or formal

reviews. It would be particularly beneficial to have the award fee rating periods correspond with other scheduled reviews, thus avoiding excessive meetings.

Having assessed the contractor's performance against stated criteria subjectively, the subjective judgement is translated to a numerical rating. The numerical rating is combined with assigned weightings for the factors for the rating period and an overall score is determined. Through the award fee formula, this score is translated to a percentage of award fee to be paid for the rating period. Once the dollar amount actually earned by the contractor has been established and approved by a designated government agent, a unilaterial contract modification is made specifying the amount of the approved award fee, if any.

It has been the experience of at least one Army contractor that the contractor has met every goal at a satisfactory level and has been content at 50% of the Award Fee (9% total fee). The extra funds not paid during the rating period have been used as a type of management reserve and have been reapplied to other work efforts.

Chapter II

The XM 712 Procurement

Nature of System

The XM 712 is a Cannon Launched Guided Projectile (CLGP) with semiactive laser guidance which is fired from a 155 mm howitzer. The item is being managed by PM, CAWS. The primary role of the projectile is long range anti-tank fire. It has a unitary shaped charge for armor penetration and therefore must hit the tank or similar hard target to be effective. It will be capable of ranges near the limits for 155 ammunition. Due to the need for a direct hit, the round must be guided during the terminal phase of the trajectory. The terminal guidance is accomplished by requiring the round to home in on a laser reflection from the target. The target is lased by a spotter with a Ground Locator Laser Designator(GLLD). Having received the laser reflection with a built-in seeker, the round is capable of anticipating where the target will be at point of impact and making appropriate flight path alterations. The initial portion of the trajectory is controlled by tail fins. Final trajectory is also fin controlled from the seeker by way of the internal gyro. Each round is expected to cost $ 3-4000.

This is the first time artillery has attempted to accurately attack moving hard point targets by indirect

fire. There are some technical difficulties in developing flight control components with sufficient hardness to survive the set back forces experienced in the cannon tube at firing, but the potential of such a system is great.

Project Status

The system is now in advanced development in response to a Material Need document. The advanced development program is being carried out in two phases with two competing configurations and two contractors. Phase I was a fifteen month effort to develop and test prototype hardware. Phase II requires the production and delivery of twelve rounds of ammunition by each contractor for government testing. Delivery is expected in January 1974. The two concepts differ only in the type of control after apogee. Both concepts are initially fin stabilized. One concept is controlled in the terminal phases by control surfaces in the forward area of the projectile. The second concept depends on manipulation of the tail fins for terminal guidance. At the end of government testing in the summer of 1974, the project manager expects to go through the ASARC II and DSARC II reviews. The current procurement plan calls for a two year effort by one contractor in full scale development. This contractor would also be awarded the Producibility Engineering and Planning (PEP) contract.

Additionally, this contractor would be awarded the low rate initial production contract and the initial production facility contract. These would all be separate contracts with the latter contracts being financed by PEMA funds. The full production contract will be awarded on the basis of competition.

At this time the project manager in considering the use of a Cost Plus Award Fee (CPAF) contract for the full scale development effort.

Special Issues

The CLGP has a contender in development. A similar requirement for a somewhat less sophisticated round is being pursued by another service. This will result in a competition for available funds though the mission requirements are different. A minimum schedule therefore will be a driving force in the full scale development effort. The project manager also desires that this development provide technology to reduce the development risks for the competitive round.

To meet the minimum schedule requirements, the contractor must expand his development effort early to correct deficiencies noted in the tests in phase II. During this period, called " free design," the contractor must quickly develop adequate solutions to design problems and complete his development on areas of risk.

It is not anticipated that the contractor will

have sufficient in-house ability to resolve these problems and must return to the subcontractors which are now employed in the validation phase. The early establishment and effective management of these subcontractors is critical to meeting the development schedule.

The contractor will be expected to develop and exercise breadboard models of components during the development prior to government buy - off on design. Accurate similation of in- bore pressure phenomenon will require an unusual amount of originality on the part of the contractor.

The warhead and fuse will be supplied as Government Furnished Equipment. The design interface will be set by the government. The prime responsibility of the contractor will be the development of guidance and control. After the period of " free design," the government will freeze the design and all further changes will be via engineering change proposals. Rapid processing by the contractor will be critical. The design freeze will come nine months prior to Development Test Operational Test (DTOT) for long lead items and four months prior to DTOT for the entire design.

The project manager wants to minimize gold plating. In any effort of this nature there is the desire to achieve an absolute maximum in capability. This reach for the last 10% of performance is normally very costly, both in

time and money. Therefore, the project manager plans to closely control the contractor to insure that the system is only good enough to meet the requirements, thereby reducing costs and schedule.

Prior to the end of Phase II the project manager must send out a request for proposal (RFP) for the full scale development phase. Responses to the RFP will be required before complete analysis of the government tests have been made. Negotiations therefore must remain open until just before the ASARC II - DSARC II reviews begin. Contractors will be allowed to modify their proposals during negotiations depending on the test results.

The government expects to closely control the development after the " free design " period. Design to cost will also be an important consideration in the development effort.

The full scale development is expected to produce a technical data package capable of being competed.

Based upon this information on the procurement of the XM 712 Cannon Launched Guided Projectile, a proposed award fee plan is presented in Chapter III.

Chapter III

Award Fee Plan For XM 712 Full Scale Development

Purpose

The purpose of this plan is to specify the responsibilities, procedures, criteria and method for determining the contractor's performance and the fee to be awarded for this performance.

Objective

The objective of this plan is to provide a method of exercising flexible control over the contractor by authorizing premiums on performance criteria that are important to the XM 712 program.

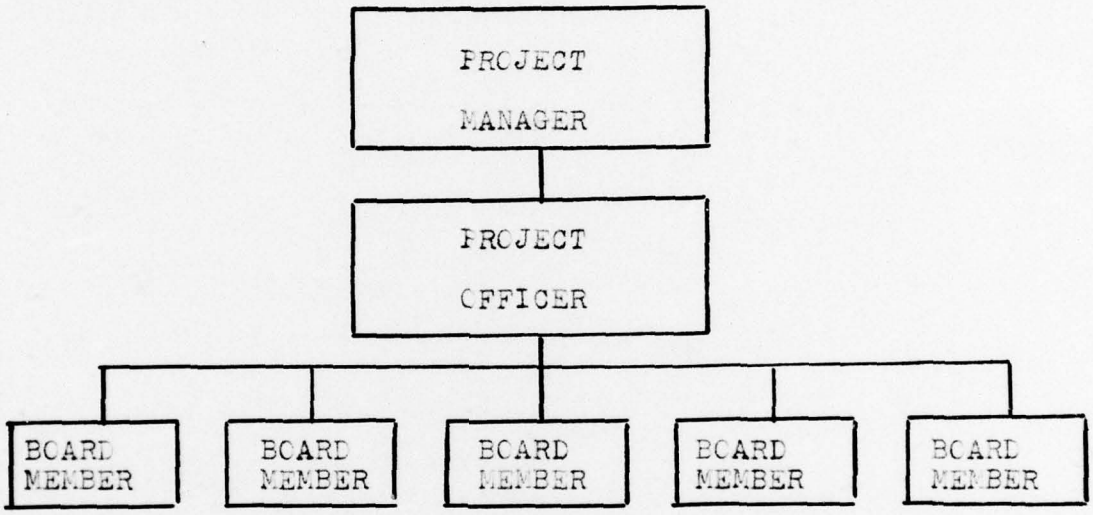
The objectives of this procurement are to:

1. Develop a unique artillery round for which the feasibility has been established.
2. Develop a technical data package capable of being competed.
3. Demonstrate that the developed round is suitable for worldwide use by the US Army.
4. Produce, if possible, a technology suitable for application to other caliber weapons at a lower risk.

Organization of Award Board

The administration of the XM 712 award fee will be conducted by a separate board consisting of the project

manager, a project officer and selected members of the project office and supporting functional directorates of the US Army Weapons Command. Figure 4 is an organizational chart.



AWARD BOARD ORGANIZATION

FIGURE 3

Responsibilities

The project manager, CAWS, is responsible for the overall performance of the award board. He will appoint board members, approve award factors and assigned weightings for the award period and will make the final determination of the amount of award fee to be paid for any rating period.

The project officer, in coordination with the board

members, is responsible for developing award factors and weights for the new rating periods, insuring that each board member is assigned an appropriate factor(s) for monitoring during the rating period and consolidating the results for review and determination by the project manager at the close of the rating period.

Board members are responsible for assisting in the establishment of meaningful factors and appropriate weights to be applied during a rating period, monotoring the contractors at the close of the rating period. Board members are responsible for maintaining their professional excellence and cognizance of the contractor's operation in their area of excellence.

Procedure

Prior to a rating period the award board will select rating factors which are appropriate for the period, develop relative weightings and present the overall recommendation to the project manager for approval.

Once rating factors have been established, the board members will make at least monthly reviews and assessments of the contractor's performance. The reviews will be based on reports, visits to the contractor or other appropriate data sources. The project officer will be advised in writing of the current status after each review. Significant difficulties will be brought to the project officer's immediate attention. At the close of

each rating period the board will be convened by the project officer to determine the contractor's performance rating and recommend an award fee for presentation to the project manager within seven working days after the close of the rating period.

The project manager may accept the board's recommendation or revise it, based on a more detailed explanation by any board member. When final award fee determination has been made by the project manager, the contracting officer will modify the contract according to the amount of award. The contractor may appeal to the project manager, providing any supporting data, within seven working days after receipt of the contract modification. Any change to the award fee, based on reconsideration by the project manager will be made by appropriate contract modification.

Contractor representation during the establishment of rating factors prior to a rating period is optional based on the desires of the project manager. In any event, the contractor will be notified seven days prior to commencement of a rating period of the rating factors and their relative weighting.

Distribution of Award Fee

The total award fee, figure 5, will be spread over eight rating periods based primarily on critical efforts expected during the rating periods. Each rating period

is approximately three months long.

PERIOD	1	2	3	4	5	6	7	8
% of TOTAL FEE	15	20	10	15	5	10	10	15

AWARD FEE DISTRIBUTION

FIGURE 5

Criteria

The award fee will be based on how well the contractor satisfied the criteria upon which his performance will be judged. The criteria are:

1. Effective and efficient technical operations.
2. Effective and efficient business management.
3. Effective and efficient problem identification, analysis, and resolution.
4. Responsiveness to technical and management changes.
5. Quality, accuracy and timeliness of reports and other deliverable data.
6. Conduction of and support to system tests.

Rating Factors

To more accurately rate the performance of the contractor, each criteria will be broken down into rating factors. The government will select specific rating

factors for any rating period. The following list of rating factors is intended as a guide, but is not limiting.

1. Effective and efficient technical operations.

   a. Scheduling and control.
   b. Establishment of technical organization.
   c. Efficient use of skilled labor.
   d. Efficient use of resources.
   e. Effective establishment and use of WBS.
   f. Effective assignment of qualified personnel,

2. Effective and efficient business management.

   a. Timely establishment of subcontracts.
   b. Control of subcontractors.
   c. Cost reduction program.
   d. Care and control of GFE.
   e. Control of overtime and other costs.
   f. Effective C/SCSC system.
   g. Effective accounting procedures.

3. Effective and efficient problem identification, analysis and resolution.

   a. Effective problem identification system.
   b. Initiative in problem solving.
   c. Effective problem solutions.
   d. Ingenuity.
   e. Allocation of resources.

4. Responsiveness to technical and management changes.

   a. Responsiveness.
   b. Configuration management practices.
   c. Complete and concise proposals.
   d. Cost control

5. Quality, accuracy and timeliness of reports and other deliverable data.

   a. Quality reports.
   b. Detailed variance analysis.
   c. Timeliness.
   d. Workmanship.
   e. Conduct of reviews.
   f. Preparation of minutes.

g. Completness of data.
h. Adherence to standards.

6. Conduction and support to system tests.

a. Timely support.
b. Effective test operations.
c. Appropriatness of data.
d. Data analysis.
e. Adequacy of test plans.

Weighting of Performance Factors

During the life of the contract, emphasis will change on rating criteria and rating factors. To demonstrate the major concerns of the government during the rating period, each rating factor selected will be weighted. The weight to be applied is as described below.

Factor Weighting	Description
4	The performance of this factor is critical to the successful completion of the project. Failure to perform at the highest level will seriously impact on schedule, cost and performance.
3	The performance of this factor is essential to the success of the project. Failure to perform at the highest level will cause a significant impact on cost, schedule and/or performance.
2	The performance of this factor is important to the success of the project. Failure to perform at the highest level may cause a minor impact on cost, schedule or performance.
1	The performance of this factor is necessary for the continuance of normal operations. Failure to perform this factor at the highest level will notcause any impact on cost, schedule or performance.

Narrative to Numeric Conversion of Subjective Rating

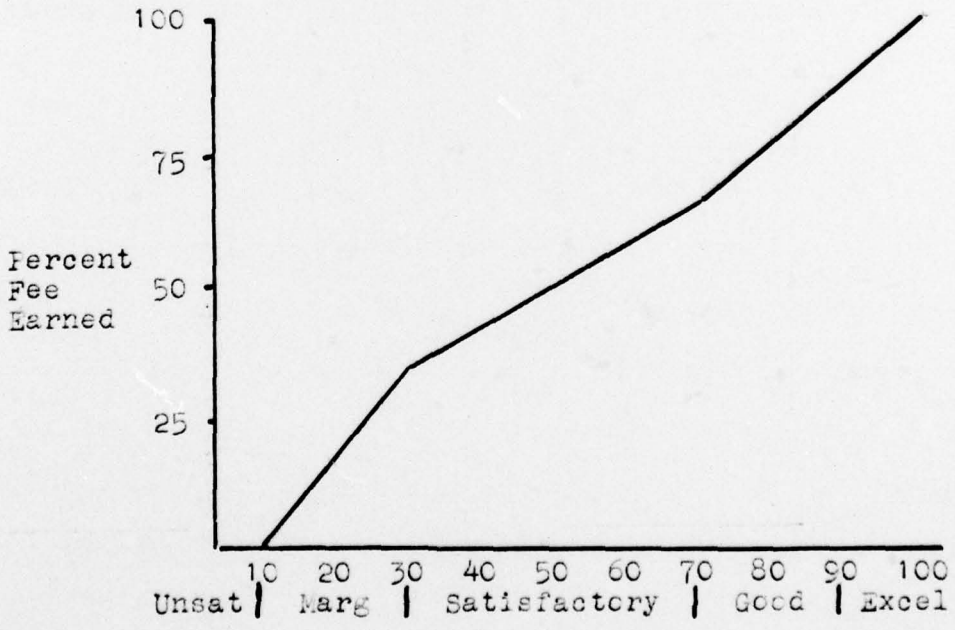
The award board will make subjective ratings of the contractor's performance against established rating factors for the rating period. To achieve a degree of uniformity among raters, the following conversion of adjective rating to numeric score will be used.

Narrative Rating	Score	Performance Description
Excellent	9-10	Performance far exceeds that expected of an average contractor for a similar task, surpassing quality, performance, schedule, or technical goals through self initiated actions. Few, if any, minor errors were made and these will have no impact on later contract performance.
Good	7-9	Performance exceeds that of average contractor for similar tasks. Above average achievement of quality, performance, schedule or technical goals. Errors were more than offset by accomplishments.
Satisfactory	3-7	Performance equals that expected from an average contractor performing a similar task. Meets standards for quality, performance, and technical goals. Errors offset by accomplishments.
Marginal	1-3	Performance less than expected from average contractor performing a similar task. Meets minimum standards for quality, performance, and technical goals. Errors are not offset by accomplishments. Minor effort required to return project to satisfactory level.

Unsatisfactory	0-1	Performance far below that expected of an average contractor performing a similar task. Fails to meet minimum standards for quality, performance, schedule or technical goals. Major effort required to return project to satisfactory level.

Award Fee Formula

After the determination of how well the contractor performed against the weighted rating factors, a total percentage score will be determined for the period. The percentage of the rating periods allocated award fee will be determined directly from the award fee formula, shown graphically in figure 5.



AWARD FEE FORMULA

FIGURE 5

Computation of Contractor Performance Score

At the close of each rating period the contractor's performance will be computed and recorded. The format that will be used is shown at figure 6. All criteria and rating factors applicable for the rating period will be entered along with the previously assigned factor weighting. Possible score will be computed by multiplying each factor weight by ten. Adjective ratings and rating scores will be entered by the board members with appropriate remarks to support the rating. The contractor's score will be determined for each rating by multiplying his rating score by the factor weight. The contractor's overall performance score for the rating period will be determined by dividing the total possible score by the total contract score and multiplying by one hundred.

Determination of Award Fee

The award fee to be paid to the contractor for any rating period will be determined through the award fee formula. Entering the formula graph, figure 5, on the horizonal axis at the performance score, the percentage of allowable award fee for the period is read directly from the vertical axis. This percent of award fee is multiplied by the allowable dollar amount of the fee to determine the award fee in dollars.

AWARD FEE DETERMINATION

CONTRACT No. _____ DATE _____

RATING PERIOD _____

Criteria	Factor	Factor Weight	Max Score	Rating	Rating Score	Actual Score	Remarks
Effective & Efficient Business Management	Control of Subcontracts	4	40	Good	7	28	
	Cost Reduction	3	30	Excel	10	30	
	Care of GFE	1	10	Unsat	0	0	
	TOTALS		480			360	

Contractor Performance Score= $\frac{360}{480}$ x 100 = 75%

Award Fee(See Award Fee Formula) = 70%

Award Fee = $ ____

Approved _____

CONTRACTOR PERFORMANCE EVALUATION RECORD

FIGURE 6

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